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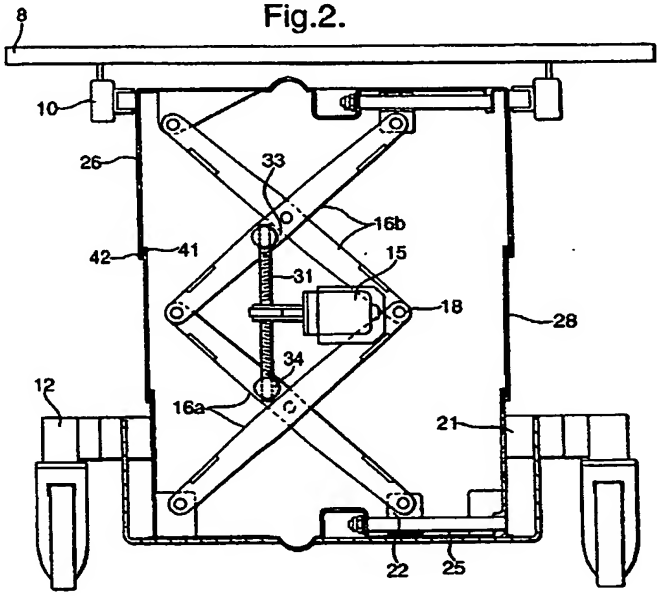
(54) Abstract Title
Adjustable bed

(57) A bed/trolley 1 comprises a platform 8 supported by telescopic columns 14 housing scissor link mechanisms.

Two matching threaded nuts 33, 34 are mounted to each half of a lead screw 31 driven by a motor 15, and to the support arms 16a, 16b of the scissor link mechanism. The lead screw 31 has one half threaded as a right-hand thread and the other half threaded as a left-hand thread. As the lead screw 31 is rotated one way the nuts 33, 34 are driven apart extending the scissor link mechanism, and when rotated in the opposite direction, the nuts 33, 34 are driven toward one another, retracting the scissor link mechanism.

The columns 14 consists of scissor link fixing brackets 21, 26 and a central cover 28 which slide within each other, providing a very low height when the scissor mechanism is retracted.

Fig.2.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

Fig.1.

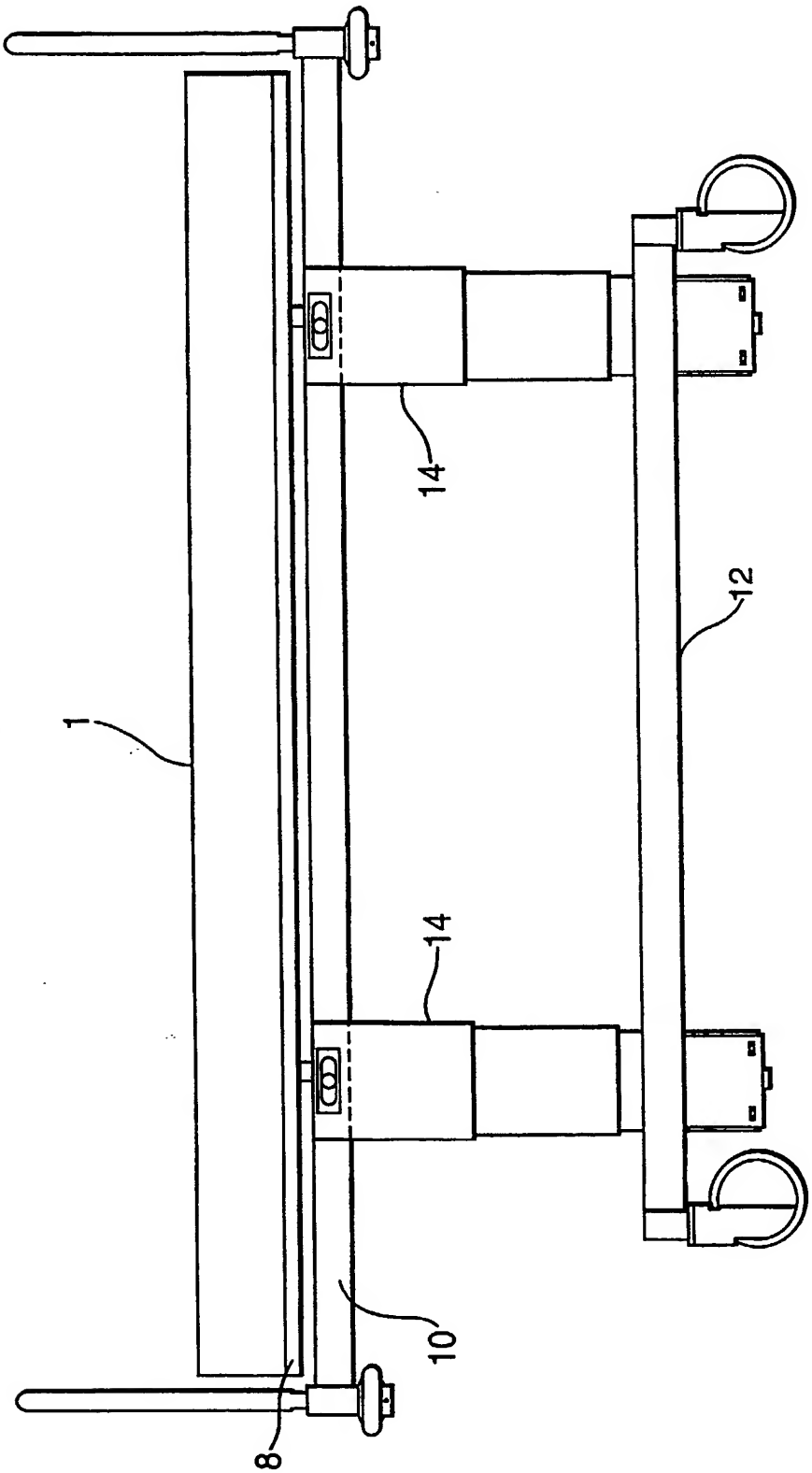
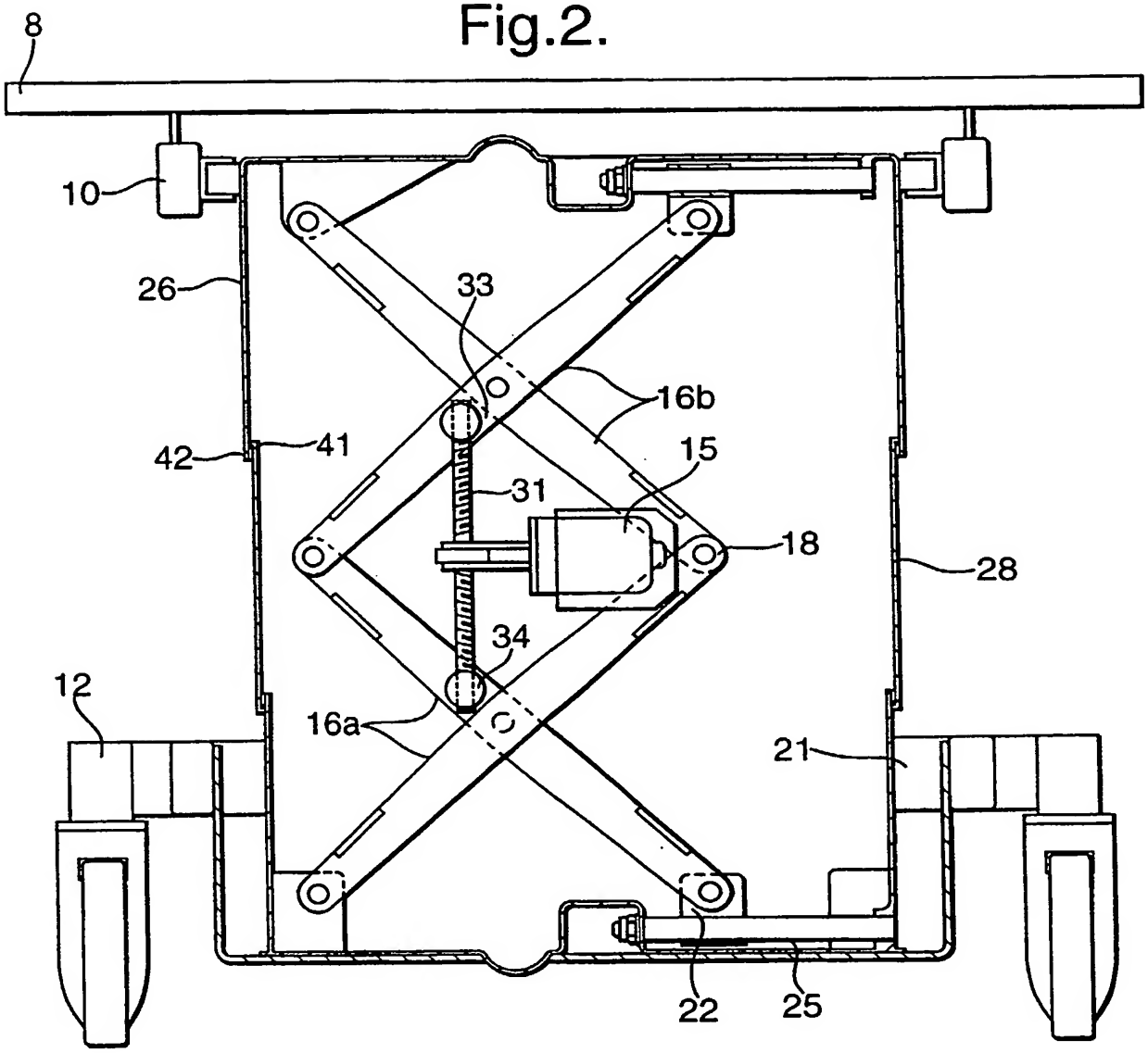


Fig.2.



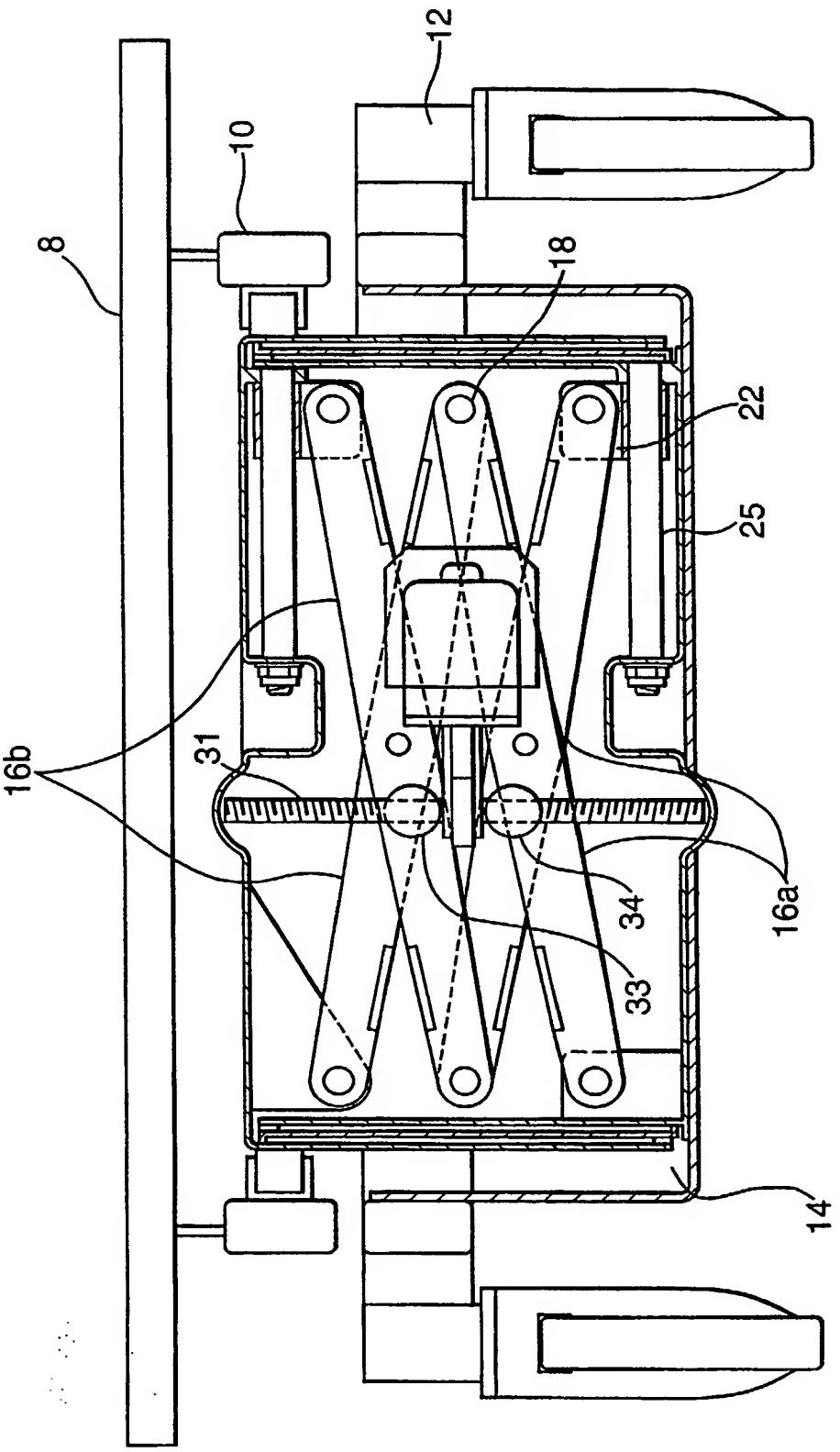


Fig.3.

ADJUSTABLE BED

The present invention relates to a hospital bed or trolley platform and in particular to the means of varying the height of a bed or trolley platform, relative to the floor.

Conventional radius arms are widely used for the raising and lowering of bed/trolley platforms but can inhibit patient hoist access when the bed is at its lowest height. They also tend to produce shearing points, which can cause damage to fingers, cables etc. Radius arms are also difficult to clean due to the presence of rotating joints and stabilising links.

Linear motion columns and scissor mechanisms individually or in combination are also known in the hospital environment, for lifting trolleys and beds.

However, the combined mechanism relies on the column structure to provide stability and guidance, with the scissor mechanism purely providing the means of lift. The scissor mechanism on its own does not provide adequate stability to support a bed/trolley platform. The scissor mechanism is driven by a motor/gearbox mounted to the base of the column. This motor/gearbox drives a single-direction-threaded lead screw on which runs a threaded nut, which is attached to the centre pivot or arm of the middle pair of scissor arms. The column structure is in three telescopic sections, with each section attached to different parts of the scissor mechanism. Thereby the sections of the column are driven upward as the scissor mechanism extends. The mechanism does not have a very short closed length. This is because a telescopic column requires each section to overlap substantially, when extended, in order to maintain stability. The amount of overlap is reflected on the closed length of the column.

The aim of this invention is to provide a direct linear motion column in a compact form with minimum

possible closed height to lift the platform, whilst providing a range of heights equivalent to existing bed mechanisms.

Accordingly, the present invention provides a platform comprising a lower frame supporting an upper frame carrying the platform, at least one pivotally interconnected scissor action link mechanism interconnecting the lower frame with the upper frame for moving the upper frame parallel to the lower frame between a lowered and a raised position, the link mechanism including at least a first and a second pair of pivotally interconnected support arms, the first pair of support arms being slidably arranged on the lower frame and the second pair of support arms being vertically arranged between the first pair of support arms and the upper frame, an electric motor drive system containing an electric motor and a lead screw, the lead screw being rotatable by the motor, the lead screw having one half threaded as a right-hand thread and the other half threaded as a left-hand thread, nut elements arranged on the adjacent interconnecting arms of the first and second pairs of support arms, the nut elements respectively being mounted on each half of the lead screw for travelling therealong, rotation of the lead screw by the motor adjusting the elevation of the link mechanism as the nut elements travel along the lead screw, such that rotation of the lead screw one way drives the nut elements apart, thereby extending the link mechanism and rotation of the lead screw in the opposite direction drives the nut elements toward one another, thereby retracting the link mechanism, the link mechanism enclosed within a housing. Advantageously, a compact direct linear motion means is provided to lift the platform, without the need for additional actuating elements.

Preferably, the link mechanism consists of a pair of interlocking support arms, each of the arms of substantial width in relation to its length, to provide rigidity and stability to the mechanism. Preferably, the support arms are hinged together with close-fitting, full- width pivot pins, in order to minimise free play within the link mechanism.

Preferably, the first and second support arms are slidably arranged at the upper and lower frames respectively by brackets such that one nests inside the other, when the scissor link mechanism is fully retracted.

More preferably, the respective brackets each interlock with a central cover to prevent ingress of dirt and air when the link mechanism is extended. The brackets and central cover thereby conveniently comprise the link mechanism housing. The housing can comprise a plurality of sections interlocking together. Since the scissor mechanism provides the rigidity and stability, the interlocking sections of the housing act purely as protection against ingress of particles and fluid. Therefore these sections only need to just overlap one another and therefore the closed height can be greatly reduced unlike the prior art columns.

Preferably, the motor of the electric drive mechanism is prevented from rotating in relation to the link mechanism via a contact block abutting the inside faces of the adjacent interconnected support arms.

Alternatively, the electric drive mechanism can be replaced by the use of a hydraulic cylinder.

According to a preferred embodiment of the invention, a bed/trolley platform is raised and lowered by means of a pair of scissor link mechanisms having a housing, one mounted at each end of the bed/trolley platform.

The invention will now be described in detail by way of example only with reference to the following drawings, of which:-

Figure 1 is a schematic view of a bed having columns according to the invention;

Figure 2 is a side view of the column and scissor link mechanism according to the invention in the extended position; and

Figure 3 is a side view of the column and scissor link mechanism according to the invention in the retracted position.

Referring to a preferred embodiment of the invention as shown in Figure 1, the bed 1 comprises a platform 8 mounted on an upper frame 10 and supported on a lower frame 12 by two telescopic columns 14 housing a scissor link mechanism. The columns 14 support the platform at the foot end and at the head end of the bed. It is possible to have only one central column 14 supporting the platform or four columns 14, two at the foot end and two at the head end. The columns 14 are all identical.

Figure 2 shows the structure of the scissor mechanism within a column 14. The scissor link mechanism is driven by motors 15 to raise and lower the platform 8 relative to the lower frame 12. The scissor link mechanism consists of two pairs of interlocking arms 16a, 16b, each arm 16a, 16b of substantial width in relation to its length in order to provide rigidity and stability to the mechanism. The four arms 16a, 16b are hinged together with close-fitting, full- width pivot pins 18, in order to minimise free play within the mechanism.

The lower arms 16a of the scissor mechanism are mounted to a base bracket 21, via a pivot to a sliding carriage 22, again via a pivot. The sliding carriage 22 mounted to guide-rails 25 rigidly fixed to the base bracket 21. The upper arms 16b of the scissor mechanism are mounted to an upper bracket 26 in a similar fashion.

Therefore, as the scissor mechanism is extended, the upper bracket 26 and lower bracket 21 are driven apart. The slide mechanisms 22, 25 at the ends of the upper and lower arm pairs 16a, 16b allow for the horizontal change in centres that occurs as the scissor mechanism is extended.

The scissor mechanism is extended by means of a lead screw 31 driven by a motor/gearbox unit 15. This lead screw has one half threaded as a right-hand thread and the other half threaded as a left-hand thread. Two matching threaded nuts 33, 34 are mounted to each half of the lead screw. One of the nuts 33 is mounted to one of the upper support arms 16a and the second nut 34 is mounted to other interconnected lower support arm 16b. The nuts 33, 34 are free to rotate in axes parallel to the pivot pins 18 connecting the arms 16a, 16b. Therefore, as the lead screw 31 is rotated one way by the motor15, the nuts 33, 34 are driven apart thereby extending the scissor mechanism. When the lead screw 31 is rotated in the opposite direction, the nuts 33, 34 are driven toward one another thus retracting the scissor mechanism.

The column housing 14 consists of the upper 26 and lower 21 brackets and a central cover 28 inbetween. The central cover 28 is free to slide in relation to both the upper and lower brackets. The upper edge 41 of the cover 28 engages with an inner rim 42 at the lower edge of the upper bracket 26 and similarly, the upper edge of the lower bracket 21 engages with an inner rim of the cover 28. Thus, as the scissor mechanism is extended, the cover 28 cooperates with the upper and lower brackets 26, 21 to bridge the intervening gap upon any extension of the scissor mechanism. The cover 28 may include one or more interlocking parts.

As shown in Figure 3, the upper bracket 26 and cover 28 nest within the lower bracket 21 to provide a very low

minimum height upon retraction of the scissor mechanism. Positional feedback of the height of the platform 1 can be either via devices mounted directly to the rotor of the motors 15 or geared off the rotor. Alternatively, feedback could be achieved by measuring the rotation of any of the pivots 18 in the mechanism or measuring linear displacement of any part of the mechanism in relation to a fixed point on either of the mounting brackets.

Our preferred embodiment uses a pair of columns 14 at each end of the bed/trolley platform, the invention is equally applicable where a single column, mounted near to the centre of the platform, would be preferable. These applications may include specialist beds, trolleys and examination/therapy couches.

CLAIMS

1. A bed/trolley comprising a lower frame supporting an upper frame carrying a platform, at least one pivotally interconnected scissor action link mechanism interconnecting the lower frame with the upper frame for moving the upper frame parallel to the lower frame between a lowered and a raised position, the link mechanism including at least a first and a second pair of pivotally interconnected support arms, the first pair of support arms being slidably arranged on the lower frame and the second pair of support arms being vertically arranged between the first pair of support arms and the upper frame, an electric motor drive system containing an electric motor and a lead screw, the lead screw being rotatable by the motor, the lead screw having one half threaded as a right-hand thread and the other half threaded as a left-hand thread, nut elements arranged on the adjacent interconnecting arms of the first and second pairs of support arms, the nut elements respectively being mounted on each half of the lead screw for travelling therealong, rotation of the lead screw by the motor adjusting the elevation of the link mechanism as the nut elements travel along the lead screw, such that rotation of the lead screw one way drives the nut elements apart, thereby extending the link mechanism and rotation of the lead screw in the opposite direction drives the nut elements toward one another, thereby retracting the link mechanism, the link mechanism enclosed within a housing.

2. A bed/trolley as claimed in claim 1 wherein the link mechanism consists of a pair of interconnected support arms, each of the support arms of substantial width in relation to its length, to provide rigidity and stability to the link mechanism.

3. A bed/trolley as claimed in claims 1 or 2 wherein the first and second support arms are slidably arranged at the upper and lower frames respectively by brackets such that one nests inside the other, when the link mechanism is fully retracted.

4. A bed/trolley as claimed in claim 3 wherein the respective brackets each interlock with a central cover to prevent ingress of dirt or fluid to the link mechanism when extended.

5. A bed/trolley as claimed in claims 1 to 4 wherein the electric motor drive mechanism abuts the inside faces of adjacent upper and lower interconnected support arms.

6. A bed/trolley as claimed in claim 4 wherein a hydraulic cylinder can be used instead of the electric motor drive mechanism.

7. A bed/trolley as claimed in any preceding claim wherein the platform is raised and lowered by means of a pair of scissor link mechanisms having a housing, one mounted at each end of the bed/trolley platform.

8. A bed/trolley substantially as hereinbefore claimed and described with reference to the accompanying drawings.